

The Regionalization of Perinatal Care in Wales and Washington State

ABSTRACT

Objectives. The purpose of this study was to compare perinatal regionalization and neonatal mortality in Wales and Washington State.

Methods. The 28 hospitals in Wales and the 80 hospitals in Washington State that offered maternity services and the 218 326 births that occurred in these hospitals in 1989 and 1990 were studied. Surveys were used to identify the neonatal technology and the referral policies of each hospital, and linked data from birth and death certificates were used to examine birthweight-specific neonatal mortality rates for all babies born in these hospitals.

Results. Welsh district general hospitals (broadly equivalent to Level II perinatal centers in the United States) have more sophisticated neonatal technology than their Washington State counterparts and appear less likely to refer small or preterm babies to regional or subregional centers. Neonatal mortality rates were quite similar in the two settings.

Conclusions. Perinatal care in Wales appears to be less regionalized than in a similar region in the United States. The relative lack of perinatal regionalization in Wales may contribute to duplication and underutilization of expensive neonatal technologies. National health care systems do not, in and of themselves, lead to optimal regionalization of services. (*Am J Public Health.* 1996;86:1011-1015)

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Introduction

Technological innovations have revolutionized the care of newborn babies in the last two decades.¹ With rapid advances occurring in the understanding of neonatal physiology, new devices have been developed for monitoring sick and preterm infants and sustaining them while they mature outside the uterine environment. This has been accompanied by a lowering of neonatal mortality, particularly in settings where there is expertise in neonatal intensive care.²⁻⁶

This study compares two places that have adopted different approaches to the provision of neonatal intensive care, Wales in the United Kingdom and Washington State in the United States. Wales has only recently begun to create a formal regionalized perinatal service.^{7,8} Washington, by contrast, has had a formal system of perinatal regionalization for over a decade, with relatively well-delineated referral relationships among all maternity units in the state.⁹ The purpose of this study is to contrast these two approaches, specifically in terms of how they affect the distribution of neonatal technology, the referral patterns for low-birthweight babies, and neonatal mortality.

Methods

Description and Classification of Maternity Units Studied

This study covers the 28 hospitals in Wales and the 80 hospitals in Washington State that routinely offered maternity services on July 1, 1991. Hospitals were classified according to the extent to which they served as referral centers for surrounding regions. In Wales, 4 hospitals

were considered to be regional or subregional centers for the provision of neonatal services.⁸ In Washington State, 6 hospitals were designated by state government as Level III perinatal units, filling a role analogous to that of the regional or subregional center in the United Kingdom.³

The second tier of hospitals in Wales included the 11 district general hospitals that were not categorized as regional or subregional centers; all of these hospitals had special care baby units and full-time obstetric, pediatric, and anesthesia staff. In Washington State, 11 hospitals served a function analogous to a district general hospital in the British system; all of these hospitals were designated as Level II institutions according to the American classification scheme.¹⁰

The third tier of hospitals in both geographic settings comprises community hospitals that provide obstetric care primarily to low-risk women in their immediate catchment areas. There were 13 such units in Wales and 63 in Washington State. Most of the Welsh units were general practitioner units, but this group also included satellite units of district

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TABLE 1—Characteristics of Neonatal Units in Wales and Washington State, by Hospital Level of Care, 1992

	Wales ^a				Washington			
	Level I	Level II	Level III	Total	Level I	Level II	Level III	Total
No. units	13	11	4	28	63	11	6	80
Average distance to referral center, miles	67	48	0	52	57	38	0	50
Hospital beds, mean	54	350	640	254	85	275	390	134
Town population, mean, in 1000s	10	53	158	48	70	133	278	94
Average no. births	192	1859	3432	1310	555	2003	2493	899
Average no. midwives	12	63	63	39	1	4	3	1
Average no. general/family practitioners	6	0	0	3	7	22	39	11
Average no. obstetricians	2	10	18	7	4	17	27	7
Average no. pediatricians	1	7	10	5	8	14	32	11
% of total births	6.8	55.9	37.4	100.0	48.6	30.6	20.8	100.0

^aWe have used the American nomenclature in our classification of the Welsh hospitals. Level I refers to community hospitals providing obstetric care for low-risk women; Level II hospitals had obstetric and pediatric staff but were not designated as regional referral centers; Level III hospitals were designated as regional perinatal referral centers.

TABLE 2—Neonatal Transport Policies of Maternity Hospitals in Wales and Washington State, by Hospital Level of Care, 1992

	Wales			Washington		
	Level I	Level II	Level III	Level I	Level II	Level III
% hospitals with gestational-age guidelines for neonatal transport	70	30	0	71	73	0
Birthweight of smallest baby kept for at least 24 hours (average for hospitals in group), g	2348	802	514	2082	1293	567
Gestational age of most premature baby kept for at least 24 hours (average for hospitals in group), weeks	36.1	25.8	24.3	34.3	29.7	24.2

general hospitals. The majority of these hospitals in both settings were in rural communities.

Technological Sophistication of Maternity Units

To compare the technological capability of the hospitals studied, we used the criteria of the British Paediatric Association for units providing neonatal care.¹¹ This schema creates three distinct groups of hospitals based on the repertoire of specialized neonatal equipment that they have available: intensive care facilities, special care facilities, and normal care facilities. (A list of the British Paediatric Association's equipment recommendations are available from the authors.)

We determined the availability of every equipment item on the British Paediatric Association's list by site visits

and telephone interviews conducted by trained interviewers from August 1, 1991, to December 15, 1992. One hundred percent of maternity units in both countries participated in the study, and complete data were obtained from each hospital.

Because neither country's birth-data tapes provide information about either intrauterine or neonatal transfer, our interviewers asked whether the maternity units had established a gestational age threshold that would mandate neonatal transfer of premature infants. Interviewers also asked respondents to review the birth logs for 1992 and provide us with the birthweight and the gestational age of the smallest and most preterm infant for which the hospital provided on-site neonatal care for at least 24 hours. The 24-hour window was used because it reflected a

decision by the professional staff to provide definitive care rather than transfer the infant to a more sophisticated neonatal unit.

Sources of Data about Births and Deaths

The Office of Population Censuses and Surveys is responsible for collecting and analyzing data about births and deaths in England and Wales. The Office provided a file containing data about all live births to residents of Wales and all births occurring in Wales to nonresidents during 1989 and 1990. The Office also provided a second file containing linked data about all deaths that occurred among these babies. Data in the files included the postal code of the usual place of residence of the mother, the hospital of birth, and the birthweight of the baby.

In Washington State, the Department of Health of the State of Washington provided us with birth certificates of all babies born in Washington State to residents of the state during the years 1989 and 1990. Death certificates of babies who died within 12 months of birth were linked to these births. The data included the zip code of the mother's usual residence, the hospital of birth, and the birthweight of the infant.

In both cases the analyses were restricted to neonatal deaths. All neonatal mortality rates were computed for the unit where the birth occurred, irrespective of subsequent neonatal transfer. If a baby was born in a peripheral unit and died after neonatal transfer to a referral center, the death was attributed to the hospital of birth. Home births were excluded from the analysis that follows.

Results

Maternity Care in Wales and Washington

There are profound differences between Wales and Washington in the size, role, and distribution of neonatal units, as Table 1 shows. In Wales, the majority of hospitals are district general hospitals, and over 90% of women deliver in these large, centralized maternity units. The majority of other hospitals are small rural units staffed almost entirely by midwives backed up by local general practitioners. In Washington State, by contrast, most maternity units are situated in community-based hospitals staffed by a mixture of general practitioners, obstetricians, and pediatricians, and roughly half of all women deliver in these settings.

Extent of Regionalization in the Two Settings

Neonatal care was much more regionalized in Washington State than in Wales, as is shown by clinical policies for the transfer of preterm infants. As Table 2 shows, only 30% of Welsh district general hospitals had specific guidelines for the transfer of preterm babies, as compared with nearly three quarters of their Washington State counterparts. Moreover, the typical Welsh district general hospital provided more than 24 hours of treatment for very preterm infants during 1992, babies that were almost invariably transferred before or shortly after birth in the American setting.

As a result, very-low-birthweight babies are much more likely to be born in a referral center in Washington State than they are in Wales. As Figure 1 shows, 65% of Washington babies weighing from 1000 to 1499 g were born in referral centers, although these hospitals account for only 20.1% of total births. In Wales, regionalization exists, but its impact is more modest. In 1989 and 1990, 45.9% of babies weighing from 1000 to 1499 g were born in regional or subregional centers, a proportion only slightly higher than the 36.8% of total births in this weight group that occurred in these institutions. Some intrauterine transfers of very-low-birthweight babies occur, but the majority of women are cared for in their nearest district general hospital, whether or not it is designated as a regional or subregional center.

Distribution of Neonatal Technologies

A much higher proportion of maternity hospitals in Wales were equipped to

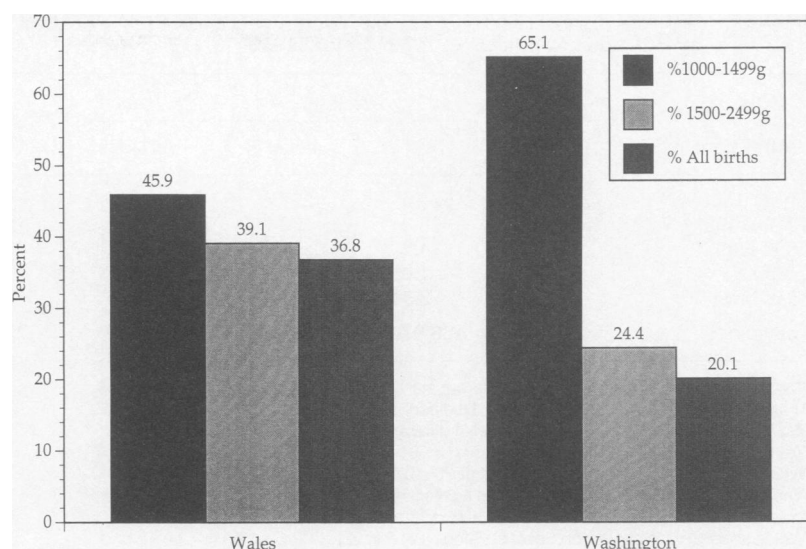


FIGURE 1—Births of very-low-birthweight (1000–1499 g) and medium-low-birthweight (1500–2499 g) babies in Level III hospitals compared with total births occurring in Level III hospitals in Washington State and Wales, 1989 and 1990.

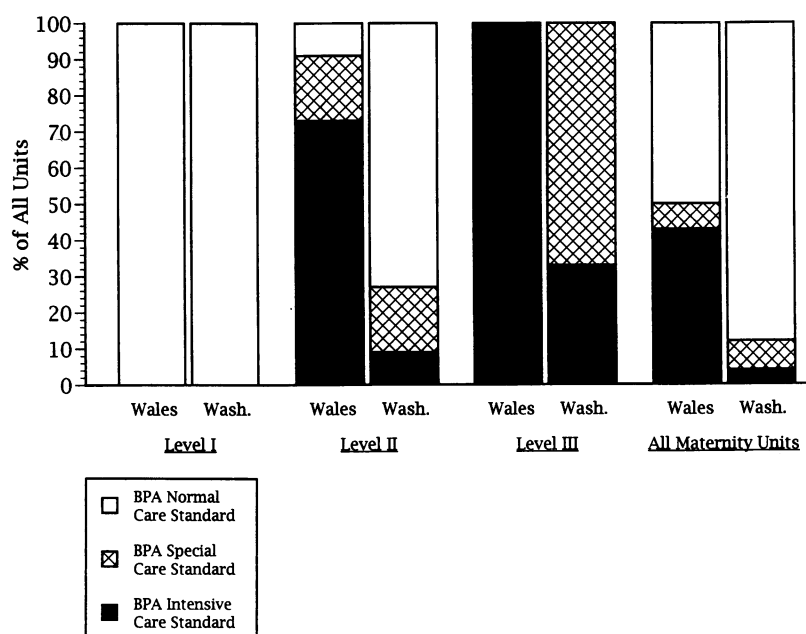


FIGURE 2—Technological sophistication of maternity units in Wales and Washington State, by facility type and British Paediatric Association equipment criteria, 1992.

the highest British Paediatric Association standard than their counterparts in Washington, as Figure 2 shows. In Wales, all the regional and subregional centers, and 73% of the district general hospitals, had

every piece of equipment that is recommended for a unit providing maximally intensive neonatal care. This includes such items as transcutaneous PO₂ and PCO₂ monitors, neonatal ventilators, and

TABLE 3—Birthweight-Specific Neonatal Mortality Rates (Deaths per 1000 Live Births) in Wales and Washington State, by Hospital Level of Care, 1989 through 1990

Birthweight, g	Wales				Washington			
	Level I	Level II	Level III	All Units	Level I	Level II	Level III	All Units
Under 1000 ^{a,b,c}	333.3	524.4	397.8	447.4	641.3	456.6	416.0	460.6
1000–1499 ^{c,d,e,f}	304.0	96.3	73.0	97.9	160.9	51.3	68.3	76.0
1500–2499 ^c	6.0	14.2	14.9	13.8	9.5	16.2	19.0	14.8
≥ 2500 ^{c,g}	1.66	1.06	1.44	1.27	1.13	1.13	2.29	1.35
All babies ^{c,f,g,h}	3.42	3.41	4.11	3.67	2.41	3.30	10.10	4.22
Total births	7 592	36 979	26 011	70 582	72 716	45 697	29 501	147 914

^aWales Level I vs Washington Level I different at $P = .05$.

^bWashington Level I vs Washington Level II different at $P = .05$.

^cWashington Level I vs Washington Level III different at $P = .01$.

^dWales Level I vs Wales Level II different at $P = .01$.

^eWales Level I vs Wales Level III different at $P = .01$.

^fWashington Level I vs Washington Level II different at $P = .01$.

^gWashington Level II vs Washington Level III different at $P = .01$.

^hWales Level III vs Washington Level III different at $P = .01$.

the ability to analyze blood gases and do biochemical analysis with micromethods. In Washington State, only three hospitals—two regional centers and one large Level II hospital—had the same range of sophisticated equipment, although the four referral centers not meeting the highest standard were lacking only the transcutaneous PCO₂ monitor.

The difference in the distribution of technology mirrors the difference in the roles of the Level II hospitals in the two settings. In Wales, most district general hospitals are equipped to provide intensive care to very small babies, and they are much more likely to retain such babies in their local facilities than comparable hospitals in Washington State. Washington State Level II hospitals have limited their investment in sophisticated technology and transfer almost all their very-low-birthweight babies to regional centers, either before or immediately after birth. By contrast, the small Level I facilities in both countries are similar to one another and are equipped only for the care of normal newborns.

Neonatal Mortality

Crude neonatal mortality rates for babies weighing over 1000 g are very similar in the two settings, 2.47 per thousand in Wales and 2.32 per thousand in Washington State. In both study settings, as Table 3 shows, babies weighing 1000 to 1499 g fared less well if they were born in Level I facilities than if they were born in more sophisticated hospitals. For Washington State, this difference extends to babies of less than 1000 g as well. Apart

from this, differences in birthweight-specific outcomes across groups of hospitals within Wales are no greater than would be expected by chance. This is compatible with a modestly regionalized system, with little technology or personnel gradient between nominal referral centers and the very well-equipped district general hospitals.

In Washington State, by contrast, birthweight-specific mortality rates for babies weighing more than 1500 g were actually lowest in the community hospitals, which leads to similar differences in the rates for all babies. This suggests that these institutions are extremely diligent in effecting intrauterine transfer of women likely to have poor perinatal outcomes irrespective of the baby's predicted birthweight.

Differences between Wales and Washington are less marked than differences within each country. Welsh referral centers have a lower neonatal mortality rate for all babies weighing more than 1000 grams than similar hospitals in Washington State, 2.7 deaths per thousand births versus 4.7 deaths per thousand. The source of this disparity is the higher death rates in Washington State referral centers for babies weighing more than 1500 grams and is comparable with the inference that in Washington State a much higher proportion of high-risk pregnancies are concentrated in referral centers.

Neonatal mortality rates for babies of less than 1000 grams shown in Table 3 should be interpreted with caution. Because of differences between Washington

and Wales in the registration of live births at less than 28 weeks' gestation, we suspect that an undetermined number of births in Wales of babies weighing less than 1000 grams with poor prospects for survival were never registered. This interpretation is supported by the observation that Wales had a greater proportion of low-birthweight babies in each 500-gram interval from 1000 to 2500 but significantly fewer recorded births of babies weighing less than 1000 grams than did Washington. This anomaly seems most pronounced in the Level I Welsh hospitals, which have an improbably low neonatal mortality rate for their 15 recorded births of babies weighing less than 1000 grams and where the only statistically significant difference appears.

Discussion

Rapid advances in neonatal intensive care during the last two decades have been accompanied by increased survival rates, particularly for the smallest and most preterm babies.^{2,5} Neonatal mortality rates within a population depend not only on technical progress, but also on social factors and the way that care is organized.^{12,13} Adequate antenatal care is necessary for the detection and prevention of maternal and fetal pathology, and a functioning regionalized system of intensive care is required to ensure that all babies within a geographic area have access to technologically appropriate care.⁵

This study shows that as of 1992 perinatal care in Wales was less regionalized than in Washington State. Most

Welsh district general hospitals had acquired an extensive repertoire of sophisticated neonatal equipment and undertook the treatment of extremely small and preterm babies. Some referral of low-birthweight babies to subregional and regional centers occurred, but it is much less frequent than in similar hospitals within Washington State. The introduction in April 1991 of the internal market—an attempt to make the British National Health Service more like the US system—may further reduce regionalization by creating incentives for peripheral district general hospitals to retain sick or preterm babies in their own facilities.¹⁴

The aim of regionalization is to improve the quality of care and avoid duplication of expensive technology.¹⁵ To the extent that birthweight-specific neonatal mortality rates reflect the quality of care, the two systems achieve comparable results for babies weighing 1000 grams or more at birth. The probability that Welsh data for babies weighing less than 1000 grams are incomplete mandates caution in generalizing this conclusion to the smallest babies. Previous studies suggest that mortality rates in Wales might be lower if regionalization were more pervasive, although there has been a lack of consensus in the United Kingdom about the advantages of regionalization, particularly for larger preterm babies.^{7,8} The implementation of the recommendations of the All Wales Perinatal Survey and the impact that the recent lowering of the gestational age for stillbirth registration in Wales to 24 weeks is likely to have on live-birth registration should allow a more precise test of this hypothesis in the future.^{7,8}

Because of incompatibilities in the data systems of the two countries, we have been unable to adjust for possible sociodemographic characteristics such as race, social status, and mother's level of education.¹⁶ The two populations are predominantly White and of European origin, with similar economic levels and cultural backgrounds. Data from the most recent censuses did show some differences in the relative sizes of the Black population, however. In Washington State, 3.1% of the childbearing population were of African-American origin, but in Wales only 0.4% of women aged 16 to 44 described themselves as "Black Caribbean," "Black

African," or "Black other," and a further 1.47% reported ethnic origins other than White. However, racial distributions should have little impact on technology acquisition or the extent of perinatal regionalization.

The acquisition of extremely sophisticated neonatal technologies in Welsh district general hospitals is due largely to generous contributions from local charities. This approach has been supported by the pediatricians in district general hospitals, most of whom have relatively extensive experience in neonatal intensive care gained during postgraduate training. Although this equipment augments the capacity of peripheral district general hospitals, much of the equipment is infrequently used given the relatively small patient volumes. When equipment is purchased, the National Health Service still has to meet the cost of maintaining and using it, so operational costs are higher in more technologically sophisticated units. Equipping and running neonatal units to the highest standards also means the spending of scarce public resources that might be better invested in other medical technologies that are much scarcer within the National Health Service context, although they might not be as popular with external charities as care for preterm babies.

It is clear from this study that the existence of a universal health care system does not in and of itself necessarily lead to optimal regionalization of care and that reliance on charitable funds for equipment can affect both policy and operations. Individual neonatal units in Wales are largely autonomous and are much less likely to work with and use designated referral centers than their counterparts in Washington State. The diffusion of expensive and sophisticated technology to community hospitals is not a phenomenon limited to the United States. □

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